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Design and development of Automated irrigation System

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***Abstract*—** This paper defines the method for development in traditional irrigation system. Using wireless Network System sensors are proposed to check soil moisture and field temperature. The system will use wireless network of soil moisture sensor and temperature sensor at root zone of plant. Data will be collected from sensors will be evaluated using algorithm. Some threshold points are to be set into micro controller for measurement. Photo voltaic panels are to be designed for power supply. Data communications will takes place with duplex communication link based on cellular-Internet interface that allowed for data analysis and irrigation scheduling will be programmed through a web page. System will be designed with low cost for water saving up to 80% compared with traditional irrigation particles of agricultural zone.

Keywords*-component; Automated System; Wireless Network System; Embedded*

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I. INTRODUCTION

In countries like India where development is mainly based on agriculture land which tends to the rapid improvement in food production technology. In our country, where the economy is mainly based on agriculture and the climatic conditions are changing throughout the year, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & land reservoir water. The continuous extraction of water from land is reducing the water level due to which water level inside is reduced to some extend. Another very important reason of this is due to unorganized use of water due to which a significant amount of water goes waste.

II. LITURATURE SURVEY

Reference [1] In this paper researcher have proven that the automated irrigation system implemented is found to be feasible and cost effective for optimizing water resources for agricultural production. This irrigation system allows cultivation in places with water scarcity thereby improving sustainability.

The automated irrigation system developed proves that the use of water can be diminished for a given amount of fresh biomass production. The use of solar power in this irrigation system is pertinent and significantly important for organic crops and other agricultural products that are geographically isolated, where the investment in electric power supply would be expensive. The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance. The modular configuration of the automated irrigation system allows it to be scaled up for larger greenhouses or open fields. In addition, other applications such as temperature monitoring in compost production can be easily implemented. The Internet controlled duplex communication system provides a powerful decision making device concept for adaptation to several cultivation scenarios. Furthermore, the Internet link allows the supervision through mobile telecommunication devices, such as a smart phone.

Reference [2] is the paper that I have referred. In this paper, irrigation management system for container grown crops is presented. It is deployed inside nursery of our institute for efficient utilization of water. Wasp-mote boards are used to sense temperature, air humidity and soil moisture after a defined interval of time and sent it to a central location via gateway. The irrigation management system separates temperature, air humidity and soil moisture values from each packet and check it against their defined threshold values. If the threshold values are crossed it activates the alarming unit and sent a message via LAN. In second phase of our experiment, the system will be capable of predicting various diseases, sending SMS automatically to the intended users and automatic plotting of data.

Reference [3] is found efficient method with low energy requirement under soil irrigation and rainfall condition for checking soil moisture. A simple four-electrode conductivity sensor is presented for the automatic logging of soil water salinity extracted from the wetting front during that part of the irrigation cycle when accumulated salts in a crop. In this paper researcher compared two month period Field data to an automated vacuum sampling system, with reasonable agreement.

III. PROPOSED SYSTEM

A. Sensor

Irrigation system sensors are complimentary units that attach to an irrigation controller and either modify the programmed irrigation cycle or stop the irrigation controller altogether. They can be inexpensive devices which are easily added to most automatic irrigation systems and ensure the landscape isn't overwatered, reducing the amount of water wasted. Sensors are used to take measurement from remote side to the master unit.

- Moisture- Using soil moisture measurements is one of the easy and simplest ways to get feedback in form of digital or analog value from controller to help make improved water management decisions. These are sensors which modify the pre-set irrigation run time based on the amount of moisture in the soil. i.e. if it has watered or rained recently and the soil is moist, it will either reduce the run time or may even stop the program
- Temperature- Sensors which are more easy and chip will regulate the irrigation cycle based on the current climatic conditions and the plants estimated demand

for moisture. Hence they are used to check environment temperature surrounding the crops.

B. Valve

Valves are devices used to control the flow of water. Most irrigation systems have both manual and automatic valves as components in the system.

- Solenoid Valve- These are automatic valves actuated from the controller that turns the water on and off to individual 'stations' or zones in the landscape. The term 'solenoid' refers to the electronic plunger located at the top of the valve body that turns it on or off when power is sent to it from the controller. Most solenoid valves also have a 'bleed' screw or switch on the valve body that is used to turn the valve on manually and is also helpful in flushing debris from the valve. Always use this when turning the valve on manually in the field.
- Pressure Valve- These are valves installed after the filter on a drip irrigation system. They can be pre-set to the required pressure and ensures that the system is operating at its optimum performance and reduce the likelihood of fittings bursting.

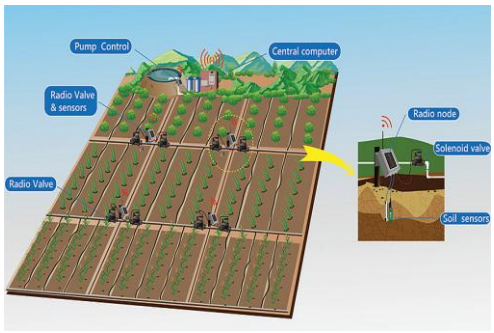

Figure 1. Sensors location in Irrigation System

C. Valve

ZigBee is a cheap, power efficient and wireless mesh networking standard. The low cost allows this technology to be widely implement in wireless control and monitoring applications, the low power requirement allows a longer life with the small size batteries, and the mesh networking provides high reliability and larger range with simple network. ZigBee has been designed to meet the growing demand for capable wireless networking between numerous low power devices.

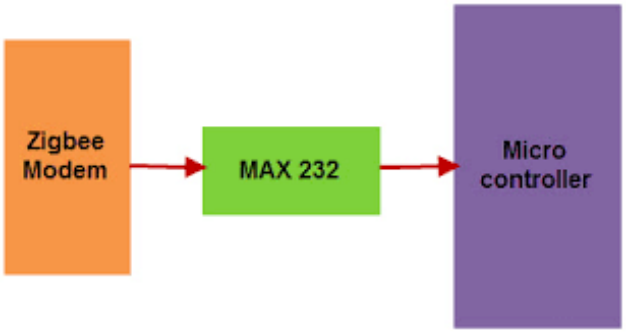

Figure 2. ZigBee Interface with microcontroller

D. Micro-Controller- System will require two microcontroller. One at field site and another one will be at controller station. To design cost efficient irrigation system we proposed to use chip microcontroller at field which will be ARM controller. Other one will be Beagle bone that will be master controller for processing collected data.

E. GSM Module- Communication between transmitter and receiver micro-controller is taken place using GPRS. For this GSM module will be used.SIM card need to insert in GSM module for sending alerts to the end user i.e. farmer.

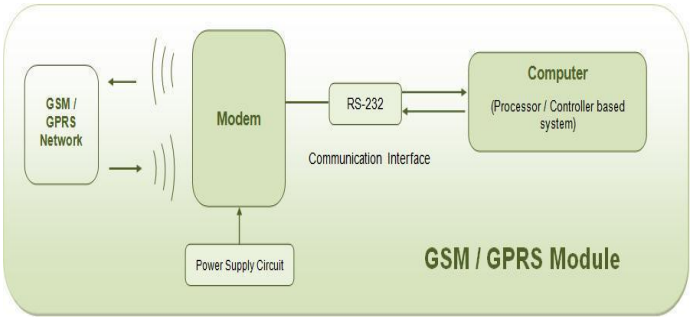

Figure 3. GSM Architecture

F. Power Supply Unit-Proposed system have Solar Panel for power supply. This will reduce the dependency on electrical supply. Hence system will be more efficient.

G. Web Application-Web Application is nothing but user can access or monitor system through internet. In this Application user should know the IP address of a microcontroller. By entering IP address he will able to access the database and can get the required data

IV. SYSTEM OPERATION

A. Working of system

A pipe with rain gun automated irrigation mechanism attached, will connected to the water pump, the another end of the pipe will be at root of the plant. The flow of water will managed by solenoid valve. The opening and closing of valve is will be operated when a signal is being passed through the microcontroller. The water to the root of plant is to be done drop by drop using rain gun and till the moisture level will become normal then sensor will sense it and it will send a signal to microcontroller and the value is then closed. Two microcontrollers will be connected using GSM. The two mobile will be connected using GSM. The GSM and microcontroller is to be interface using MAX232. When moisture of the soil become low moisture sensor will sense it and it will send signal to microcontroller, then the microcontroller will sends the signal to mobile and it activate the controller which sends output to master unit. This indicates that valve needs to be opened by pressing the button in the called function signals are sent back to microcontroller

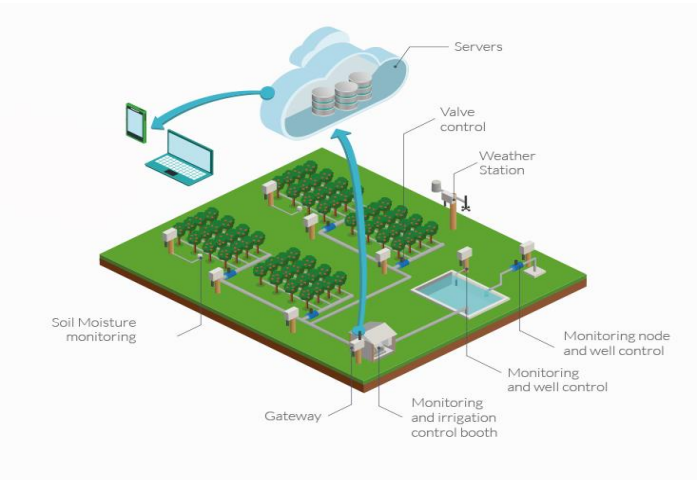

Figure 4. Proposed System

B. Software Design

This system contains software part for Master controller. This part has GSM Module which stores data from WSN, evaluate it and keep updated to user.

- Transmission and reception of sensor measurement using ZigBee transceiver.
- Read the sensors values through Master controller unit
- According to readings, send commands to relay switches to on off solenoid valves and water pump.
- Send SMS to user with current status

C. Algorithm

System follows below steps to execute the irrigation.

- Step1: Start
- Step2: Initialize power supplied to GSM and Controller
- Step3: Check the moisture level of soil
- Step4:If level will be more than 50% no need to irrigation
- Step5: If moisture level less than 50% start irrigation
- Step6: Initialize the pump and rain gun
- Step7: After completing process reset the system
- Step8: Stop the process.

V. SUMMERY

This system provides efficient way for Irrigation. In this system solar panel is used hence power it is power efficient as well especially for rural area where power supply is not regular. Proper Monitoring of temperature and soil moisture gives automation to Pump and Valves. Hence this system will be most helpful to farmers.

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